Linux in Mobile Computing Research

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Mobile Computing

- Vision
  - Access to computing and networking resources whenever and wherever you are.
- Many aspects involved eg hardware design, wireless design, software design, networking.
- Some Networking Issues:
  - Wireless environment
  - Disconnected operation
  - Mobility support
  - Mobile agents

Mobile Networking

- A subset of the field of mobile computing.
- Concerned specifically with the layer–3 networking aspects of mobile computing.
- Some Mobile Networking Issues:
  - Mobility support. (routing)
  - QoS support.
  - Efficient use of bandwidth (multicasting).

Mobile IP protocol

- An Internet based protocol that allows users to move seamlessly from one IP subnet to another.
- Developed by the IETF Mobile IP WG.
- Useful technology when:
  - Mobile hosts require a fixed–IP address eg for servers residing in the mobile host.
  - Frequent movement from one IP subnet to another eg in certain wireless cellular data network architectures.

Mobile Networking At NUS

- Mobile Computing Group formed in 1995.
- Consists of two supervisors; Dr KC Chua and Dr YC Tay, and a group of students.
- Currently stationed at two places:
  - CCN Lab, Dept of Electrical Engineering, NUS
  - Mobile Computing Lab, School of Computing, NUS
- Mainly working on the Mobile IP protocol.
- Moving into QoS and ad–hoc networking field.

Mobile Networking at NUS

- Our research focus concerning Mobile IP:
  - Portability and Deployment
  - Wireless and QoS

Our contributions to MIP research

- Push for deployment:
  - Billing protocol, RAT
- Further research:
  - RAFA, Fast Handoff, mobile QoS, multicast support
- Collaboration with the IETF:
  - Proximity Proxies, SOMIP, PAID, MVPN, RAT, RAFA Internet–Drafts
- Implementation of schemes

Linux at Mobile Computing Group

- Linux is the prevalent OS used in our group.
- Linux used as:
  - Desktop OS
  - Simulation platform
  - Prototype implementation platform

GPLed Mobile IP source code

- Kernel–space MIPv4 implementation on Linux 2.0.34. Features:
  - Mobile IP base protocol.
  - Route Optimization.
  - Bi–tunnelling.
  - Multicast support (bi–tunnel scheme).
  - Regional Aware Foreign Agent and Fast Handoff.
  - Mobile Middleware.
  - Mobile QoS scheme along with RSVP.

GPLed Mobile IP source code

- MIPv4 user–space implementation.
- MIPv6 kernel–space implementation.
- PPP changes to support Mobile IP.
- Reverse Address Translation (RAT).
- Source code available freely at http://mip.ee.nus.edu.sg

Other GPLed code by MCG

- Implemented QoS support in 2.0 kernels:
  - Packet scheduling for Linux 2.0:
    - Ported ALTQ packet scheduling framework to 2.0.34.
    - Class–Based Queueing (CBQ).
  - RSVP for Linux 2.0:
    - Ported ISI USC's RSVP to 2.0.34.
    - Implementation of Tunnel Support for RSVP
    - Mobile QoS scheme along with Mobile IP

Further Information on MCG

- NUS Mobile IP web site
  - http://mip.ee.nus.edu.sg
- The CRAM Project
  - http://cram.iscs.nus.sg:8080/cram/

Other Useful Sites

- Mosquitonet Mobile IP
  - http://mosquitonet.stanford.edu
- HP Labs Mobile IP
  - http://hplbwww.hpl.hp.com/people/jt/
- SUNY Binghamton Mobile IP
  - http://anchor.cs.binghamton.edu/~mobileip
- Mobile IP at SUN
  - http://playground.sun.com/pub/mobile–ip

Other Useful Sites

- Lancaster University MIPv6
  - http://www.cs–ipv6.lancs.ac.uk/ipv6/
- CODA
  - http://www.coda.cs.cmu.edu
- Internet Engineering Task Force (IETF) Web Page
  - http://www.ietf.org

Looking for developers

- Some possible future projects:
  - Port NUS MIP to 2.2 kernels and glibc.
  - Implement other packet schedulers.
  - Implementation of DiffServ in Linux 2.0.
  - Implementation of MANET in Linux 2.0.

Linux Advocacy

- Companies in Singapore and this region can help promote Linux by:
  - Using Linux in corporate environment.
  - Providing Linux support for their hardware products.
  - Develop software products for Linux.
  - Donate Linux CDs and Linux tech support to people in developing nations and schools.
  - Donate old computer hardware to developing nations and schools.

Non–linux Wacky Ideas

- Effects of open source concept:
  - Empowerment to the people
  - Return to the roots – DIY hobbyist – Fun fun fun!
- Extend open source and GPL concept to:
  - Hardware projects
  - Ideas
  - Biodiversity wealth